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PRELIMINARY MAP
OF
THE SOUTH COAST OF BAFFINLAND
Reduced from the Original Track Survey,
by
Dr ROBERT BELL
during the season of
1897.

The Coastline has been adjusted to observations for latitude and longitude and variations of the Compass by Dr R. Bell

Scale, 1:1,000,000 or 15·78 = 1 Inch.

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F S Weller, F.R.G.S. lith.

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A SURVEY IN BAFFINLAND, WITH A SHORT DESCRIPTION OF THE COUNTRY.*

By ROBERT BELL, M.D., LL.D., F.R.S., of the Geological Survey, Canada.

THE following paper will give an account of a survey of part of the southern coast of Baffinland, and of an exploration into the interior of that great island in 1897, both of which are shown on the accompanying map. The sending out of the steamship *Diana* by the Government of Canada in that year, to make further investigations as to the navigation of Hudson strait, afforded the Geological Survey of the Dominion an opportunity for two parties to go at the same time to examine the rocks and make topographical surveys on both sides of the strait.

The writer was placed in charge of the work on the north or Baffinland side, and Mr. A. P. Low of that on the opposite shore. We were provided with small yachts, 35 feet long, well built, and good sailers, but incapable of resisting ice-pressure. They had each a comfortable little cabin, a coal-oil stove for cooking, and accommodation forward for four seamen. The yachts, and a boat for each, were carried to the strait, at some inconvenience, on the deck of the *Diana*, and launched on the

* Map, p. 120. All names which had been given to localities in the area covered by this map are retained. The additional ones have been given by Dr. Bell as necessary for the purpose of description.

arrival of the ship at our respective destinations. Each took 3½ tons of pig-iron as ballast, and we found room to stow away enough of provisions, petroleum, camping outfit, clothing, ammunition, etc., to last for a year in case of necessity.

The *Diana*, a Newfoundland sealing steamer, with a total company of forty-three persons, left Halifax, Nova Scotia, on June 3, and, going by way of the west coast of Newfoundland, passed through the straits of Belle Isle three days later without delay, but when off Hamilton inlet, we became surrounded by a wide field of ice, and lost about ten days before we got free again. On June 22 we reached the entrance of Hudson strait, and found the sea thereabouts all clear of ice. In steaming up the strait, however, we kept too close to the north shore, and got caught in drifting ice at Big island, which stands boldly out from the mainland, and is exposed to the full force of the ice-floe along the shore. After having been unpleasantly jammed for some time at this place, we got away and steamed, without difficulty, into Hudson bay, which we reached on July 12.

The programme laid down for the *Diana* by the Department of Marine and Fisheries required her to make a voyage completely through the strait as soon as she should arrive there, then to land the Geological Survey parties; after which she was to make occasional voyages between Hudson bay and the Atlantic. In the course of one of these trips she was to pick up the geologists and their men and convey them to St. John's, Newfoundland, and then return again and navigate the strait till as late a date as possible.

My yacht and stores were put off the ship at Ashe inlet, Big island, on July 20, and it was arranged that she should call for me again at the same place on September 10. In the mean time, I proposed to examine and map as much as possible of the coast, and, if time permitted, I intended to do some exploring in the interior. I had already made several voyages through Hudson strait, one by the Hudson's Bay Company's barque *Ocean Nymph* in 1880, and the others by the expeditionary steamers *Neptune* and *Alert* in 1884 and 1885, so that I was already tolerably familiar with the landmarks and the character of the strait. If a chart had existed by which it might have been possible to recognize with certainty any point about the entrance to Fox basin, I could have met the ship there, and so have saved a long return journey in my yacht, but the above inlet was the only locality sufficiently well fixed to make a sure rendezvous.

My main object was to investigate and bring away a record of the geology of the coast, and this required a topographical survey of some sort to give it a permanent value. On account of the great distance to be traversed, the intricacies of the coast, the swiftness of the tidal currents, the dangers and interruptions from running ice and other difficulties which we encountered, I soon found that it would be impossible

to undertake an exact instrumental survey of the coast in the time at my disposal. I therefore determined to make what we call a track-survey, which means the mapping of the geographical features by the best method available. In this case the track-survey consisted of a rough triangulation by approximate bases measured by our progress in a given time, with many intersections of courses, and by constantly taking bearings and estimating distances to all points in sight. These formed the basis of diagrams, drawn to a scale, of section after section of the coast and islands as we went along. The more detailed contours of the shorelines, the positions of islands, etc., were often sketched with the aid of compass-bearings from the tops of hills overlooking the sea. A large number of positions were fixed by means of many observations for latitude, and of numerous others for longitude. On putting the results together, it was found that the diagrams required to be only slightly adjusted in most cases, in order to correspond with the positions thus established, so that the accompanying map, reduced from a compilation on a large scale, is a fairly accurate representation of about 200 miles of the southern coast of Baffinland, both as to distance and correctness of position throughout. Charles island and a portion of the south shore of the strait, shown on the accompanying map, were sketched partly from the *Diana*, whose rate of steaming was known, and partly from excursions by land and row-boat, all aided by numerous bearings, while the *Diana* was in these parts, before landing me at Ashe inlet. The general position was fixed from astronomical observations by Captain Whiteley of the *Diana*.

I had no assistant, and the duties of a geological surveyor on an undertaking like the present one were of a varied character, consisting, among other things, of a general superintendence of the sailing of the craft; judging what was best to be done under the constantly changing conditions, by watching the wind, tide, currents, etc.; making the track-survey by the above methods; taking observations for latitude, longitude and magnetic variation; making tidal observations, notes on the topography, on the dip or strike and character of the rocks, on glacial phenomena; taking the heights of mountains, waterfalls, etc.; photographing; collecting, preserving, and packing geological, botanical, and zoological specimens, etc. On land journeys, other labours were necessary in order to make good progress. I had an intelligent native guide, who understood some English, and every spare moment on the yacht was utilized in constructing a vocabulary of the Eskimo language, which I was afterwards able to check by the help of an educated young half-breed belonging to the same people. In doing this, I had an English dictionary before me, and I selected all the more important words in their proper order.

As most persons know little about Baffinland, it will be desirable to give a short general description of the country before mentioning the

results of my own investigations. Baffinland is a large island on the west side of Baffin bay, or opposite to Greenland. It stretches from Hudson strait, north-westwards through twelve degrees of latitude, or from 61° 40′ to 74° N. It is the third largest island in the world, being only exceeded by Greenland and Australia. Its total length is 1005 English statute miles, and its breadth varies from 200 to 500 miles, the average being 305. The area is, therefore, about 300,000 square miles, or about ten times that of Scotland or Ireland. It forms, however, only about one-tenth of the superficies of the Dominion of Canada. Notwithstanding its immense extent, it appears to be of no great value, since it is composed, as far as we know, of barren rocks, partly covered with ice.

It was formerly supposed to consist of a number of separate islands, called Cockburn island, Baffin's island, Cumberland island, Fox Land, Meta Incognita, Sussex island, etc., but it has been pretty satisfactorily ascertained that these are all united, and form the great island now known as Baffinland. The south-eastern part was discovered by Sir Martin Frobisher in 1576, and in 1578 it was named Meta Incognita by Queen Elizabeth. Captain John Davis discovered the land around Cumberland sound in 1585, and Captain William Baffin found the northern part of the island in 1616. The present designation is not new, for in 1821, Sir W. E. Parry proposed it for all the northern part, in honour of Captain Baffin, who was regarded as an able and enterprising navigator. From the above-mentioned dates, it will be seen that all these lands formed part of the British possessions on this continent, by right of discovery, dating from 183 to 143 years before our acquisition of Canada. They were formally transferred to the Dominion, along with all other islands lying north of the mainland of America, by an Imperial order in council on September 1, 1880. These circumstances give us a good enough title, so that it was not necessary to "raise the flag" to assert that they belonged to the Empire, as was done on the occasion of the visit of the *Diana* to Cumberland sound in 1897.

Baffinland has a generally bleak, mountainous, and barren aspect; but on the west side there is an extensive low and comparatively level area, underlaid by horizontal Silurian limestones, stretching inland from Fox basin to the great lakes of the interior. A similar area, underlaid by the same kind of rocks, occurs at the northern extremity of the island. Dr. Franz Boas spent the years 1883–84 in Baffinland, and in winter he travelled extensively by dog-sleigh all along its north-eastern side. We are indebted for most of what we know of these parts to his observations and maps, published in 1885.* According

* Dr. A. Petermann's 'Mitteilungen aus Justus Perthes Geographischen Anstalt, Ergänzungsheft,' Nr. 80. Gotha, 1885.

to these, the mountains form three principal ranges, all trending north-west, or parallel to the longer measurement of the island. The highest runs along the north-east coast, facing Baffin bay; the middle range is between Cumberland and Frobisher sounds, while the third, or southern one, extends along the north-east side of Hudson strait from Resolution island to Fox basin.

Northward of Cumberland sound, the broad north-eastern range forms a great plateau from 5000 to perhaps 8000 feet in height, covered with a cap of ice, resembling the similar covering of Greenland, while the valleys in the remainder of the range to the northward (probably not quite so high) are filled with ice, which, in some cases, descends as glaciers to the sea. The higher parts of the middle range may be from 2000 to 3000 feet above the sea. The southern range, as far as it can be seen from Hudson strait, appears to be from 1000 to 2000 feet high. The actual measurements which I made of some of the hills of this range were confined to the middle portions, where they are lowest, the highest parts being towards both the south-eastern and north-western extremities.

The summit of that part of the southern range lying between Hudson strait and Frobisher bay is covered by a long smooth-topped cap of ice, forming the Grinnell glacier. The dimensions of this glacier are not accurately known, but the length is somewhere between 70 and 100 miles, and the breadth may be about 20 miles. The Eskimo call it Ow-u-i-ta. The charts, which are very imperfect, represent it as discharging into several of the inlets on the south-west side of Frobisher bay. The Eskimo described to me one discharge of this kind, called Pakaluia, not far to the north-westward of Gabriel strait, and they stated that the bergs that float up the north side of Hudson strait, and which are all small, come from this locality.

In connection with the existence of this great glacier in the extreme south of Baffinland, the question may be asked, why there are no glaciers further up Hudson strait, on Southampton island, or in any part of the Labrador peninsula. This fact is probably owing partly to great local differences in the amount of precipitation, and, in the case of the northern portion of Labrador, to the circumstance that the mountain range near the sea is too narrow and steep to retain even the relatively small quantity of snow which falls upon it. Further inland the country is much lower, and is mostly wooded. Throughout the northern part of the Labrador peninsula there appears to be less snow than in the regions further south, and consequently the material is not present for the creation of glaciers. In these latitudes, the amount of snowfall is, no doubt, largely influenced by the temperature of the adjacent sea during winter. The ocean current, impinging on the east coast of Greenland, flows around its southern extremity and up the west coast; then it crosses to the Baffinland side, and a part of it finds its way up

the north shore of Hudson strait, and this crosses to the south side, in the western part, and flows out along the southern side, where the current appears to run constantly eastward. On the northern side of the strait, at each tide, the current flows longer to the west than to the east. This is easily seen by the movements of the small icebergs which occasionally pass up on this side. In Greenland, the high land, together with the ocean current, having some degree of warmth, which has just been mentioned as flowing round the southern part of the great island, afford very favourable conditions for the accumulation of its enormous glacier. The same current, passing down the eastern coast of Baffinland and around its southern extremity, furnishes the necessary marine conditions, while the extensive high lands adjoining the sea in these parts allow the heavy snows of winter to accumulate. On the other hand, the cold sea surrounding the Labrador peninsula, the dry winter air of the interior, and the moderate elevation of the land, all combine to prevent the formation of glaciers south of Hudson strait.

The country, for a long distance inland from the south side of Hudson strait, is not wooded, except at the bottom of Ungava bay, and consequently driftwood is almost absent from the greater part of this shore. The northern part of the east coast of Labrador is also destitute of timber, and there the ocean current flows south. No trees of any kind grow in Baffinland. The set of the currents in Hudson strait would render it impossible for driftwood, even if present on the south side, to cross to the north shore, yet trunks of small spruce trees are not uncommonly stranded at high-water mark all along the latter. Whence has this wood come? The only answer appears to be that it has been brought by the current, which, after flowing round Cape Farewell and across Baffin bay, passes up this coast. In that case, its original source would probably be in some of the rivers of northern Siberia, from which it would be carried by the current that Dr. Nansen describes as flowing thence across the polar region and on towards Greenland. Some of these small trunks have the long butt due to having grown in alluvial soil, where the tree threw out fresh roots above its original ones, on account of the accumulation of silt around its base. This circumstance also points to the earthy banks of the Siberian streams, rather than the rocks of Labrador, as the birthplace of these trees.

During the Tertiary period, all the land in the north-eastern part of North America is believed to have stood at an elevation of several thousand feet above the present levels. At that time the site of Hudson strait and its continuation, Fox channel, formed a land valley, extending from the south side of Melville peninsula to the Atlantic ocean, a distance of fully 700 English statute miles, with an average breadth of 100 miles or more. It probably contained a great river, which had numerous large branches traversing what is now the bed of Hudson

bay, and converging in its north-eastern part. The bottom of this great inland sea is very level, and in most of its area it is covered by less than 70 fathoms of water. Few soundings have been recorded in Fox basin, and it is likely to prove even shallower than Hudson bay. The submerged valley of Fox channel and Hudson strait deepens as it goes towards the ocean, and gives soundings of 340 fathoms and upwards before intersecting the present line of the Atlantic coast.

After the close of the Tertiary period, the elevated land on either side of Hudson strait became covered with ice. A study of the glacial striæ of these regions shows that in Baffinland, to the north of the great depression, the ice moved southward and fell into it, while to the south, in Labrador and the northern part of the present bed of Hudson bay, it moved northward to the same huge reservoir. The ice from both

TYPICAL VIEW ON SOUTH COAST OF BAFFINLAND.

directions, which thus came together, filled the wide valley and moved eastward or down-grade to the ocean, as shown on either side, by the forms of the glaciated rocks, the directions of the striæ, and the composition of the drift.

Lakes appear to be scattered everywhere among the mountains in southern Baffinland, but there is what may be specially designated a great lake region in the central part of this half of the island. Two of the lakes which occur there are worthy of a short notice. The southernmost, Lake Amadjuak, which I visited, may be 120 miles in length by 40 in breadth in the middle, with an elevation of about 290 feet above the sea. It lies in a north-west and south-east direction, between the southern and middle main ranges of mountains, already described. When I first came in sight of this lake, not far from its central part,

it was bordered on the south-west side by a generally level plain, dotted with hummocks of Laurentian rocks, which also partially surrounded Lake Mingo, 15 miles in diameter, and lying quite close to Lake Amadjuak. Immediately overlooking these plains, the north-eastern side of the southern range rises, rather abruptly, to a height of 700 feet, or 1000 feet above sea-level. From the top of a hill, which I called Mount Mingo, 966 feet, by barometer, above the lake of the same name at its base, some high points, covered with snow, were visible a long way off to the east in the mountains of the middle range on the opposite or north-east side of the big lake.

According to native accounts, Lake Amadjuak discharges northward into Lake Nettilling (which may be 140 miles long and 60 miles broad) by a short river with no rapids, and up which the Eskimo can paddle their kyaks; and Lake Nettilling drains into Fox basin by a large and somewhat rapid river, with a course of 50 to 60 miles, and it must therefore have an average descent of about 5 feet per mile. My guide said the name of this stream was Nowata, but on Dr. Boas' map it is called Koudjuak. Both of these great bodies of water are larger than any lake in the whole peninsula of Labrador, which measures 1000 miles each way, and they may almost be compared to Lake Ontario in extent. The Eskimo informed me that the country is level about the north-western half of Lake Amadjuak and all around Lake Nettilling; also from both these lakes to Fox basin. The name Nettilling means "flat-floor." Reindeer are plentiful in summer on these wide plains, but in winter they go into the mountains. As already mentioned, this level country is no doubt underlaid by horizontal limestone. A corresponding low tract of similar limestone occurs in the eastern part of Melville peninsula, on the opposite side of Fox basin. Mansfield island is formed of flat-lying grey limestones, and these I found to contain fossils of the Niagara formation. Drift fragments of the same kind of limestone coming from the country on the east side of Fox basin, contain fossils of this formation, and I have no doubt the rocks of the two regions are correlated. At the head of Frobisher bay, and on its south-eastern side, is an isolated hill of limestone, shale, and marl belonging to the Trenton or Galena formation of the lower Silurian system. It is called Silliman's Fossil mount, and has afforded over seventy species of fossils, many of them new to palæontology, but, as a whole, they correspond to the Manitoba and Minnesota fauna of this horizon, rather than to that of the Trenton in the Ottawa and St. Lawrence region. Other isolated patches of these rocks and one outlier of the Utica or next higher formation occur in other parts of Frobisher bay.

The general appearance of Baffinland, as viewed from the sea, is mountainous, rugged, bleak, and barren. Bare black-looking rocks are almost everywhere in evidence, both along the coast and on the sides and crests of the mountains. But on going inland in the middle of

summer and looking over the country from a height, this appearance is somewhat relieved by green-bottomed valleys, where grasses and sedges grow among the stones, and also by occasional patches of dwarf vegetation on the hillsides, and here, on a sunny day, we may find many bright arctic flowers of various colours. The general blackness of the rocky landscape is sometimes varied by white spots and long narrow banks of snow on northern slopes sheltered from the sun's rays. Beautiful blue lakes may be seen here and there at different levels among the mountains. The clear brooks and small rivers which discharge the waters of these lakes from one to another, are almost sure to end in fine cascades when they plunge over the last ridge into the head of some inlet or bay. I collected over a hundred different species of plants, and, if time had permitted, probably a good many more might have been found. The general dark appearance of the rocks is due to a growth of lichens on their surface.

Returning to the subject of my own journey in 1897. After the yacht had been launched in Ashe inlet, Big island, on July 20, we were obliged to remain for a day at anchor at the head of the inlet on account of a strong head wind. There was no darkness at that season, and we sailed at two o'clock next morning. We had only gone a few hundred yards, when the sound of a human voice, from a long distance behind, reached us in the calm northern air. We immediately put about and dropped the anchor. With a couple of men, I rowed back in the boat, following up the direction from which the sound was coming. At length we saw a big Eskimo man standing on a rock at the edge of the water, with his gun on his shoulder, but carrying nothing else. As we approached, he greeted us like an old friend, and pointed out the way for us to come to the rock he was upon. As soon as we touched it, he jumped into the boat as if he belonged to the party, and showed great delight in joining us. He had been out hunting till late the previous evening, and had lain down for a nap near our anchorage. The noise we made in getting under way had wakened him up. On reaching the yacht, he was the first to climb on board, and he immediately made himself quite at home with us. He was demonstrative, talkative, and bubbling over with good nature. Unlike an Indian, he was anxious to show us how much English he knew, and I was glad to find he could understand us fairly well. He said he was familiar with the whole coast, and had also travelled in the interior. I told him I was going a long way up the strait, that I might be away two moons, and asked him if he would come with us as guide. He joyfully accepted my offer, and began at once to make himself useful. Towards the middle of the day, the ice blocked our passage so completely that we were obliged to turn back. Our guide, whose name was Twimi, now advised us to go round the eastern extremity of Big island, and said we would find but little ice in the north channel. The evening was beautiful, with a

light fair wind, and as soon as we had rounded the east point, we came upon a large camp of Eskimo. They surrounded us in their kyaks and omiaks and regarded us with the most unaffected friendship, both the men and women shrieking and cheering with delight, like so many children made suddenly happy. I now discovered that Twimi's family, consisting of his father, mother, wife, sister, and several children, were among the party camped here. I told him to go ashore and get what things he might require for his journey, and to rejoin us at some islands which were in sight a few miles off, where I intended to anchor for the night, in order not to be troubled by our new-found friends. He was afraid to quit the yacht, however, in case we might sail away and leave him behind, so he asked a couple of young men to come after us in their kyaks with certain articles which he enumerated. I was glad he had had this chance to communicate with his family, whom he had never mentioned to us. If we had succeeded in passing up the outside of Big island, they would have had no means of knowing what had become of him until he could find them on some of their wanderings after his return.

During our entire cruise we tried to find a harbour every evening, but did not always succeed in doing so, and consequently we spent some anxious nights, watching the movements of the ice and the rushing tides. By constant vigilance we managed to escape any harm, and we brought back our yacht without its having suffered the slightest damage. The whole coast is well supplied with good harbours. In the course of our explorations we discovered twelve, roomy enough for large vessels and affording complete shelter with convenient depths of water and good holding-ground in every instance. Sketch-charts of several of these were made and lines of soundings run, which may be of use some day if Hudson strait should be utilized for navigation to a greater extent than it is at present.

From Big island to Fair Ness, the outer ridge of the southern range skirts the sea-coast. This section is remarkable for six great bands of coarsely crystalline white Laurentian limestone which are here exposed. At 12 miles north-west of the extremity of Big island, a narrow entrance leads into Crooks inlet, which is from 3 to 4 miles wide and extends for 20 miles into the land. Good sections of five of these bands may be seen in this inlet, the bluffs and hills on either side consisting of these rocks together with gneiss in about equal proportions. The dip here and elsewhere along the coast is almost invariably inland or to the north-east. Twelve of these enormous limestone bands, besides numerous smaller ones, were met with between Icy cape and Charkbagh, and I have calculated that their aggregate thickness may amount to the enormous total of 30,000 feet. One of them, which comes to the coast at Wharton harbour, is better exposed than most of the others, and I estimated its thickness at 5700 feet, or upwards of a mile, and yet it

may not be the thickest of these immense bands. The facts I was able to ascertain prove that these limestones extend from the Lake Amadjuak route to the head of North bay, a distance of 130 miles by a breadth of 40 miles, and from their trend it may be inferred that they will continue south-eastward and come out successively to the shore of the strait at different points between North bay and the Middle Savage islands. In no other part of Canada, nor in the United States, has such a volume of these limestones been found. They go far to prove that the newer Laurentian rocks are a sedimentary and not a foliated granite series.

Behind Fair Ness is a bay running back 20 miles from the ness, with a length, parallel to the strait, of 25 miles, which I named Markham bay. It contains many islands and points, and along its north-east

HEAD OF NORTHERN INLET, NORTH BAY, BAFFINLAND.

shore the land is lower than elsewhere on the north side of the strait. The coast is also comparatively low to the northward of Big island. From Markham bay, for 100 miles north-west, the main shore is bordered by an archipelago of islands about 25 miles broad, embracing all sizes, from mere rocks up to 10 miles in length. They seem to be innumerable, and there must be many thousands of them. As a rule, the islands are smaller and more widely scattered towards the outside of the archipelago, and progressively larger, higher, and closer together, as we approach the solid land. In going towards the main shore, it is impossible for a stranger to distinguish the islands from the continuous land. The former become larger and higher, and the channels between them narrower and narrower, until at length they terminate among the hills without connecting to form islands. The condition may be best understood if we imagine a rugged country, like that behind this coast, and

having a general descent to the south, to be continued under the water of the strait till it is half submerged.

My longest journey inland was the one made northward from the head of Amadjuak inlet or fiord, to the shores of Lake Mingo, close to Lake Amadjuak. We found a perfect and easily accessible harbour at the head of the fiord. The Alice river dashes into it by a foaming rapid past the foot of an isolated conical hill. This river forms the connecting links between the various lakes of the chain in a valley leading in the direction we wished to go. Leaving the yacht in charge of two sailors at the harbour, I started on foot with the other two seamen and my Eskimo guide, who said he knew the way to the big lake. After we had gone part of the distance, we found that he had been over the route only by kyak, which he "portaged" between the lakes, and in trying to steer the best course by land, he was sometimes at fault. The men's packs were comparatively light, as we did not expect to be gone more than a week. They contained a tent, blankets, cooking-outfit, and provisions, whilst I carried what instruments were required.

The hills were rugged, steep, and covered with boulders, and we found the best walking along the bottoms or sides of the valleys, especially where these were terraced. But in following the margins of the lakes, it was annoying to find our way occasionally blocked by a precipice, or a bluff with deep water at the foot. This necessitated climbing up high steep hills, and sometimes making a considerable *détour* before we could resume our march in the valley. In some places, on the sides of the valleys and elsewhere, rounded boulders of gneiss were piled in the form of ridges and small hills without any fine material among them. At a few localities I saw good examples of osars, or ridges of sand and gravel without any boulders. Well-marked terraces at various altitudes, up to more than 400 feet above the sea, occurred here and there all along the valley of the Alice river. Marine shells of a few common northern species were found in several localities in the drift of this valley up to an elevation of 110 feet above sea-level. At one place the bouldery clay containing these shells had been disturbed by ice-pressure, showing that here there had been two periods of glaciation. We left the main valley of this river at Stevenson lake, and crossed the hills north-westward to Gilbert lake on one of its branches, a distance of $2\frac{1}{2}$ miles.

All the streams flowed towards Hudson strait till we came near to Winchell lake, when they began to run northward in the direction of Lake Amadjuak. The last body of water before reaching Lake Mingo, and which I called Walcott lake, lay directly across our course. It has an elevation of 243 feet, by barometer, above Lake Mingo, and nearly the whole of this descent is in a single cascade at its outlet, which falls directly from a notch at the level of its surface and at right angles to its straight northern side. We were obliged to go round to

the east end of this lake, and from it we crossed the high rocky hills to the northward. At the top of the one which I called Mount Mingo we obtained a fine view over Lake Amadjuak, on which no white man had ever before gazed. On descending to the shore of Lake Mingo, which lay at its foot, carrying with me two good barometers, I found the height of the mountain to be 666 feet. By a comparison of elevations, that of Lake Mingo would be about 300 feet above the sea, and the mountain would therefore be 966 feet above the same level. Lake Amadjuak was estimated to be about 10 feet lower than Lake Mingo. From the top of Mount Mingo I took several photographs, giving a panoramic view of the lakes and the plain between them. The north-east side of Lake Amadjuak could be seen in the dim distance, and I estimated its width to be at least 40 miles, and it may be considerably greater.

In our weary walk along the stony margins of the chain of lakes which we followed, varied by *détours* over the high rocky hills in order to reach Lake Amadjuak, I could not help wishing for a canoe, by which the journey would have been accomplished with greater ease and in less time. Travelling by this means, only about six rather short portages, and one of $2\frac{1}{2}$ miles, would require to be made, as may be seen by the accompanying map, in order to go from Amadjuak harbour to the lake of the same name.

On our return journey, we took a more western route from McGee lake to Greeley lake than the one we followed in going, and thus we passed by several lakes we had not before seen; but the general character of all these sheets of water is much the same. The banks are sloping and covered with stones and boulders, having a growth of coarse grass among them, while craggy mountains rise everywhere just behind. The heights of the principal ones we passed over on either side of the Alice river varied from 1050 to 1150 feet above the sea.

In two of the valleys we crossed I saw miniature glaciers, but in each case they had evidently been formed by the continued freezing of the overflow of a stream choked by the frost, so that in the course of the winter, or perhaps of several winters, a great accumulation of ice had taken place. In summer these streams had cut canyons completely through the ice, and were flowing among the boulders underneath it.

An interesting feature in the physiography of this region was the great number of sparkling rills of the clearest water which crossed our path along the sides of the valleys. Sometimes, for miles, we would pass one of these rivulets at every few hundreds of yards. They ran down the slopes in trenches or little channels cut in the drift with a regular flow, gurgling over clean red, white, and grey pebbles and cobble stones, and tempted the perspiring traveller to

drink the ice-cold water oftener than was good for him. The source of all this water seemed to me to be from the steady thawing of the deeply frozen ground, or of the ice among the drift on the higher levels during the summer weather.

I took the temperature of six of the lakes we visited by a tested Cary thermometer, with the following result: Orton lake, August 11, 50° Fahr.; Walcott lake, 14th, 51°; Lake Mingo, 14th, 48°; Merriam lake, 17th, 50°; a bouldery lagoon off Greeley lake, 17th, 58°; Gertrude lake, 18th, 50°. The high temperature in the lagoon, which was at the mouth of Boulder river, was due to the fact that the water, for some distance above it, spread among a wide and even field of boulders, all of which became heated in the sun, and so warmed the water, and also to its exposure in the quiet shallow lagoon itself. We happened to halt for our mid-day meal at this place, and while it was being prepared, I took off my clothes and plunged in for a bath, to the great delight of the Eskimo Twimi, who had never before seen a human being swimming. The whiteness of my skin and the frog-like movement of my body interested him immensely, and he inspected me with child-like glee, first from the top of one big boulder and then from another.

Our method of cooking will interest any one who may contemplate a trip like ours in any similar subarctic region. At our first camping-place, the two sailors and I went off to collect any dead stems we could find of the root-like or creeping dwarf willows, in order to make a small fire to boil our kettle. On our return, Twimi said they were no good. He had in the mean time built a little chimney of stones, taking advantage of an angle in the rocks, and after collecting an armful of the large growing tufts of a heath-like plant, very common everywhere in these parts (*Cassiope tetragona*), he made them burn in his chimney, sending a strong flame out at the top. By feeding it in as rapidly as it consumed, from a heap with which we supplied him, he soon made our kettle boil at the top of the chimney. A knowledge of the fact that this plant may be thus utilized in a green state, in fine weather at any rate, may save travellers carrying an unnecessary quantity of alcohol as fuel. There is a slight objection to its use, from the fact that a sticky gum from its smoke condenses on the outside of your kettle or pan.

We got back to the yacht on the eighth day after leaving, or on August 18, having spent four days in going, one day round Lake Mingo and three days in returning. Two days were rainy and six were fine, and during the latter both mosquitoes and black flies were very troublesome. Lake Amadjuak proved to be about 50 miles from our harbour. My record of distances was kept principally by pacing and time estimate, but four latitudes were also taken by sextant. I obtained a considerable number of photographs on gelatine films, which served to illustrate all phases of the scenery.

On my return to Amadjuak harbour, I found the fiord nearly clear of ice, and we left immediately to resume the survey of the coast to the north-west. We reached Charkbagh fiord, said to be the longest inlet on the north side of Hudson strait, on August 22, and I judged it best to turn back the next day in order to be reasonably sure of keeping my appointment to meet the *Diana* at Ashe inlet, on September 10. On the way back I made a track-survey among the islands lying outside of those we had been among going up the strait, and we anchored again in Ashe inlet on September 1. During the interval between this date and the 10th, I surveyed North bay nearly to Icy cape, and returned to the inlet in time for the *Diana*, which sailed with us for St. John's, Newfoundland, on September 12.

LOOKING UP CANYON INLET, BAFFINLAND.

Our general experience during this yachting cruise on the southern coast of Baffinland may deserve a passing notice. As a rule, the weather was fine—too fine, perhaps, as there was much dead calm, which hindered our progress. It, however, also included fogs, high winds (sometimes amounting to gales), rains, and some decidedly cold spells. Although on calm, sunny days we found the weather quite warm inland, on the sea there was a constant feeling of cold or rawness and discomfort, on account of the presence of so much ice.

The tides in Hudson strait are very high, being fully 30 feet at Big island, and considerably more at the head of Ungava bay; but at the entrance of Hudson bay they become, all at once, very moderate, owing to the pent-up water being relieved by the sudden expansion into Hudson bay to the south, and Fox bay to the north. Near the shore the difficulties incident to the great rise and fall of the water

are increased by the velocity and uncertainty of the currents generated by the high tides. The different depths and directions of the channels among the islands and the irregularities of the coast give rise to cross-currents running to all points of the compass, races, tide-rips, and a very rough sea when much wind is blowing. The time over which my experience extended was so short that it did not enable me to find the hour of high and low water. The sluggishness of the common compasses, which were all we had, and the great amount of the declination, varying from 57° to 64°, caused much inconvenience, both in navigating and in making the track-survey. Our difficulties with the ice, as well as the tidal currents, apply, of course, only to the coast, and do not in any way bear upon the question of the navigation of the main strait by large vessels. At the same time that the whole width of the strait outside of the islands is quite clear, the ice may be lodged here and there in the fiords and among the islands all along the north shore. In sailing in a small craft in these parts, the swift currents, just referred to, bring the ice down upon you in the most extraordinary manner. The ice-pans appear to drift capriciously backward and forward, and, without any apparent cause, they will select some unexpected course and insinuate themselves into an open bay, harbour, or channel. You may be comfortably anchored for the night, and congratulating yourself on your good luck, when you will see a pan of ice gliding rapidly into your harbour, soon followed by another, and this by many more, until, in less than an hour, your snug shelter is filled up and you are a prisoner, in danger of being pushed upon the rocks. With very little wind, you may be barely keeping ahead of an ice-field following you up, when all at once you see another coming across from one side to intercept your course. You turn to avoid it, and soon meet a third, running from some other direction. Sometimes it is a race between you and a grinding field of ice to reach a gap, by which you hope to escape into open water beyond, before the narrow space is blocked up.

Little is known of the fish of Baffinland. As before mentioned, the cod is said by the Eskimo to abound in Frobisher bay, as it does around Cape Chidley, and Dr. Boas mentions a place much further north, to which the natives resort to live upon this fish for a certain period. The cod also occurs in Hudson bay, as proved by myself in 1877 and by Mr. Low in 1899. In 1880, I found a small halibut floating on the surface in the straits. Sea-trout enter the mouths of nearly all the streams, and we saw speckled trout jumping in the lakes of the interior, but salmon do not seem to frequent the north side of the strait. In 1884, I dredged in from 20 to 40 fathoms at Big island, and found pretty much the same aggregation of crustaceans, mullusks, and radiates as we get at corresponding depths in the gulf of St. Lawrence. Several species of marine mammals, some common and some rare, are to be

found on the north side of Hudson strait, among them being the walrus, the narwhal, and the polar bear, the Greenland whale, the bottle-nose, the fin-back, and the little white whale, besides two or three other cetaceans. The seals of this coast include the bearded or square flipper, the Greenland or harp, the fœtid or ring seal, and the harbour seal, and other species are said to be taken occasionally.

The terrestrial mammals of Baffinland are confined to a few species, among them the reindeer, of which single individuals were seen everywhere we went; but the greater number of these animals move about in herds, and are found in different districts at different seasons. The other mammals are the arctic hare, the wolf, the white and the blue fox. The red fox and its varieties are not found in Baffinland, although common on the south side of the strait. We sometimes saw a mouse or mole darting from the shelter of one rock to that of another, and it is probable that the foxes subsist mainly on these; but I saw no evidence of the existence here of the large yellow-cheeked meadow mouse, which is abundant on the west side of Hudson bay. Some of the Eskimo we met knew about the musk-ox, and said it lived in the northern part of the island. Of the few birds we saw in the interior, ravens, arctic loons, rock-ptarmigans, and snow-birds were the most frequent. The black guillemot was common, and the least auk rare on the coast. The trumpeter swan and the common eider breed on Nottingham island. At Charkbagh I saw two large flocks of Canada geese flying due south on the night of August 22, but this bird was not seen further east.

Although the air was always cold on the water, by going a few miles inland, on a bright day, one found quite a different atmosphere, and the comforting sense of warmth in the pure air was quite exhilarating. If calm, the flickering appearance of the heat over the rocks was more manifest than in the regions further south. In the bright sunshine the arctic flowers of many hues would be all wide open, and little butterflies of various different species could be seen flitting about in considerable numbers, making the most of their brief time for enjoyment. Of all insects, the lepidoptera were most in evidence, and I collected fifteen different species. Besides these, black flies, mosquitoes, and two species of bumble-bees were the only insects noticed. On such excursions one missed the elsewhere familiar grasshoppers and crickets, dragon-flies, beetles, ants, and other insects. It is an interesting fact that Mingo, the name of one of the large lakes, means "ant," and it is possible that ants may be found on the plains around this lake, which is far away from the cold sea-air. In the lakes and streams, no larvæ of insects, no shells, no crayfish or frogs or newts, are to be seen, and on the land there are no toads, snails, slugs, or spiders.

The absence of birds of prey, swallows, singing birds, and squirrels

is also noticeable, and contributes to the feeling of solitude one experiences in this treeless region.

The Eskimo are not numerous in Baffinland. From what I could see and learn in 1897, the total native population of the south coast and southern interior is only about 170, while that of the west or Fox basin side may amount to one hundred more. The bulk of the population on the eastern side of the island has gathered at the two whaling stations of Kekerten and Black Lead in Cumberland sound, where many of them are employed. According to the report of the commander of the *Diana*, they numbered about 400 in 1897. This would give a total population of about 670 for the whole of Baffinland.

ESKIMO KAYAKING NEAR AMADJUAK BAY, BAFFINLAND.

The old tradition that the Eskimo are a people of small stature still obtains in some quarters, but is without foundation. On the contrary, in Labrador, Baffinland, and all around Hudson bay, the height of the men is probably above, rather than below, the average of the human race; but, as a rule, the women, although very strong, are considerably shorter than the men. We always found these people honest, cheerful, frank, and friendly. They are brave, industrious, provident, and communicative, in all of which characteristics they contrast with the northern tribes of Indians. Their skins are often greasy or dirty, because it is difficult to have them otherwise in cold weather and in the absence of soap or warm water or anything to serve as a towel, and because, for ages, custom and good form never required anything else; but wherever they have been shown the use of soap and can obtain it, nothing pleases them more than to wash themselves.

They eat most of their flesh, fowl, blubber, and fish in the raw state, not from choice, but necessity, for they can seldom obtain either vessels or fire for cooking. But when they own a kettle or pan and can procure wood, they cook their meat, and enjoy it much more in this form. At the end of our explorations, when I had paid Twimi (in hardware, ammunition, etc.) for his services, and we were about to steam away in the *Diana*, he thanked me for having paid him so much, but more especially for the bountiful meals of hot cooked food we had given him every day while he had been with us.

Before the reading of the papers,* the PRESIDENT said: This Society is so closely connected with the Antarctic Expedition that I will read a telegram which has just arrived from Dr. Nansen: "The Conference of the International Investigation of the Sea, now meeting in Christiania, expresses its goodwill towards the British Antarctic Expedition, and sends best wishes for its success.—NANSEN, President."

We have two papers this evening relating to the very northern part of North America, one by Dr. Bell, who is well known to us, who has just succeeded our gold medallist, Dr. George Dawson, as director of the Geological Survey of Canada, and the other by his nephew, an extremely promising geographer and geologist, Mr. Bell. Dr. Bell's paper is on the south part of that great island, Baffin island, the great mass of land opposite Greenland on the western side of Davis strait and Baffin bay. The other paper is on the region so well known to us as having been traversed by Sir John Franklin and others, the country between Great Bear lake and the Arctic ocean on the northern coast of North America. I regret that both the authors are absent. We had hoped that Mr. Bell would have been here, but he was telegraphed to, to return to Canada, and therefore I will read you an abstract of the papers.

After the reading of the papers, the following discussion took place:—

Mr. J. G. COLMER: You have asked me to address the meeting, but your request has come upon me rather suddenly. I did not know that I should be called upon to speak at all, and I rise naturally with some diffidence, because I know nothing personally of the region about which we have heard such interesting matter this evening. But I am not ashamed to make that statement, because we all know Canada is a very large country. I have been over a good deal of it myself, but I have never had the good fortune to visit those far northern regions which Dr. Bell and his nephew have described. I have read about them from time to time, but although I have not been there, I have the pleasure of knowing Dr. Bell very well, and also his nephew, and many other members of the Canadian Geological Survey to which they belong; and am aware also, as are many members of the Geographical Society, of the very valuable services they have done in exploring the less accessible parts of Canada. Their reports are published annually, and are looked forward to with very great interest, and to my own knowledge several very interesting papers have been read in this hall from time to time about many parts of Canada with which we are not many of us very familiar. I cannot speak of the Geological Survey of Canada without mentioning the name of one who was well known to us, Dr. Dawson, and whose recent death is a loss to geographical science all over the world. Like many others, I came here to-night to obtain information rather than impart it. I think I shall be expressing the feeling

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* A paper by Mr. Mackintosh Bell on Exploration in the Great Bear lake region was read at the same meeting; it will be published shortly.

of the meeting when I say we have all been very interested in the papers by Dr. Bell and Mr. Mackintosh Bell, illustrated as they have been by the admirable photographs; and I am sure Dr. Bell and Mr. Bell will be highly gratified by the reception accorded to their papers. Papers of this kind make us understand practically how little we know after all of the vast territory which makes up the Dominion of Canada. At the present time, although we have a population which the present census will probably show is somewhat in the neighbourhood of six millions, we may say that even yet only a very small fringe of the country is inhabited. There are immense territories which are only partially explored, and we are learning year by year of the riches of Canada and of the various sources of wealth with which the different parts of the country have been endowed. Naturally the principal industry of the country at the present time is agriculture, but we are daily finding new riches in the way of minerals and other resources; and it is a very curious thing that, although we hear from time to time of lands in remote portions of Canada which are described as inhospitable and barren, we are apt to be surprised when in a few years the discovery of gold or some other form of wealth has led to thousands of people congregating in these particular regions. The discoveries in the Yukon and the Klondike districts may be mentioned as instances. I am sure we have all listened with very great interest to the papers we have heard to-night, and I am only sorry that I cannot say more from personal knowledge of the particular districts which have been discussed.

Colonel Church: I scarcely anticipated being called on, from my special field of South America, to speak on the northern part of North America; but I may be able to point out one or two things of special interest. I am greatly pleased to find attention drawn to this region, and more especially by an old friend of mine —Dr. Bell. Year after year Canada pushes her explorations to the north, and with great profit to science and to her own prosperity. If we look at the development which has taken place in Canada, it is surprising to find that it has been almost confined to the southern fringe of the country. Canada seems to be sailing like a badly laden ship—all on one side. The great heart of the country has yet to be touched, and in that great heart, I believe, will be found riches more vast than in any part that has yet been developed in the Dominion. Exploration has been made with a view to reaching Hudson bay from Europe by way of Hudson strait, but it is as yet, I believe, doubtful whether useful navigation can take place there. However, the province of Quebec—and I am subject to correction by those gentlemen who are more familiar with Canada than I am—is now making efforts to reach Hudson bay by rail, and I understand they have before the Government to-day an application for a privilege to run a railway northward, and then to make a little branch to the southern end of Hudson bay, where they can reach about 20 feet of water for several months of the year. The immense wealth, however scattered it may be, can then be taken out to Quebec. Then, if we move westward along the Laurentian range of hills, we find a great forest of spruce and trees of that nature, which is rapidly being cut for the purposes of building and for pulp manufacturing, and a great many mills are being established along that line. All that range, about 1500 miles in extent, is covered by a great wooded belt, and I think has also been found to promise to be very rich in minerals, especially copper and mineral phosphates, and perhaps other minerals of value. At the same time, instead of its being a country lacking in agricultural possibilities, it has also been found, even on the Hudson bay slope, to be very rich in agricultural land here and there. But going west and tapping the very heart of the Dominion north-west of Lake Winnipeg, to Fort Simpson on the Pacific coast, we shall find, perhaps, as fine a wheat-field as there is in the world. I may say it amused me two,

years ago at Dover to hear Sir William Crookes starving us to death in the matter of wheat, when there are at least 200,000 square miles of wheat lands west of Lake Winnipeg with a climate better than on the frontier of the United States, and where the snow does not fall so deep, and the prairies are exceedingly rich and fertile. The climatic conditions of north-west Canada are largely due to the Japanese current. It is the northern deflection of the most powerful oceanic river of the world—the equatorial current, which daily moves, from east to west, several tens of thousands of cubic miles of warm water. When it reaches the island district south-east of Asia, it divides and sends a greater part of its vast volume northward. This skirts the Japan coast, where it is known as the Kuro-Sivo current. It then turns eastward, runs south of the Aleutian islands, impinges against the shores of Alaska, and continues south-east along the coast of California. The soft winds which sweep over it cross the Rocky mountains where they are low, and, pouring into the region north-west of Lake Winnipeg, give it a warmer climate than is found on the western section of the Canadian Pacific railway, 5° of latitude further south. In fact, in 56° N. lat. in the Peace river valley, and also at Pori Simpson on the Pacific coast of British Columbia, the climate is not so severe as at Montreal, and at the above port strawberries ripen in June in the open air. The Rocky mountains abreast of Port Simpson have passes under 2500 feet elevation above sea-level, while further south they increase in altitude, and the Canadian Pacific railway has to cross them at about 5000 feet elevation, their general altitude being such that they interrupt the passage of the warm winds from the ocean. It is perhaps worthy of remark that the shortest line that can be drawn, north of the Gulf of Mexico, between an Atlantic port and a Pacific one, is from Quebec to Port Simpson, and that the distance from Liverpool to Yokohama or Shanghai, taking this route, is 800 statute miles shorter than any existing one. Broad statesmanship might regard this fact as presenting a good opportunity for a British answer to the Trans-Siberian railway.

The PRESIDENT: We have now merely to thank the authors of these two papers. And, turning to a purely geographical point, I would mention that Dr. Bell has not communicated a paper to us for the first time. I think it was almost twenty years ago that he gave us a most interesting paper on the capability of the navigation of Hudson bay, and more recently he was here himself and read a paper on the country south of James bay. I think there are few men in Canada who have done so much and laboured so hard as Dr. Bell has for the development of that country. Almost every year we have interesting papers from him in the publications of the Canadian Geological Survey, and I am now glad to congratulate him on his appointment as Director of the Geological Survey of Canada. We all regret very deeply the loss of our gold medallist, Dr. Dawson. I would also point out that, although Dr. Bell has given us this interesting account of the southern part of Baffinland, there is an enormous extent of country absolutely unknown. That part of the coast-line beyond and to the north and west of the point reached by old North-West Fox, in 1635 I think it was, is still absolutely unknown and unvisited, and clearly, from the description that Dr. Bell has given us of the country he has visited and of these vast lakes, one of which he saw, and which was then, I believe, for the first time seen by a white man, we may expect, in a country that is absolutely unknown, most interesting results for future explorers connected probably with the Canada Geological Survey. Dr. Bell's nephew also has done most valuable geographical work in correcting the very erroneous map made by the Abbé Petitot, who certainly communicated to us a most interesting paper, but who appears not to have been very accurate in his survey. I have not the slightest doubt, from what we have seen of young Mr. Bell's paper, that he will walk in his uncle's

foo steps and become a most valuable and accomplished geographer and geologist. They have given us two most interesting papers, and I am sure the meeting will wish me to convey to them a vote of thanks, not only for the papers which they have communicated to us, but for the exceedingly interesting photographs which accompanied them.

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